

Claims

1. A production process for a liquid concentrate of adapted and viable bacteria, for use in foodstuffs comprising the following successive steps:

a) the bacteria are propagated in a fermenter in an appropriate culture medium;

b) the bacteria obtained are adapted to step a);

c) the culture medium containing the bacteria adapted by tangential microfiltration is washed using a washing solution;

d) the washed medium containing the bacteria adapted by tangential microfiltration to a bacterial concentration greater than $5 \cdot 10^{10}$ ufc/ml advantageously greater than $1 \cdot 10^{11}$ ufc/ml are concentrated in bacteria;

e) a liquid concentrate of adapted and viable bacteria for use in foodstuffs is recovered.

2. The process as claimed in Claim 1, characterised in that the bacteria are lactic bacteria, in particular bacteria of *Lactobacillus* spp, *Bifidobacterium* spp, *Streptococcus* spp and *Lactococcus* spp genera.

3. The process as claimed in Claim 1 and 2, characterised in that the culture medium of step a) is a synthetic medium.

4. The process as claimed in any one of the preceding claims, characterised in that the culture medium containing the bacteria in the fermenter at the end of step a) has a pH between 3 and 6.

5. The process as claimed in any one of the preceding claims, characterised in that the concentration of bacteria at the end of propagation step a) is greater than $2 \cdot 10^{10}$ ufc/ml.

6. The process as claimed in any one of the preceding claims, characterised in that adaptation of the bacteria

conducted in step b) is revealed by measuring parameters of the culture medium and/or parameters of the bacteria.

5 7. The process as claimed in Claim 6, characterised in that the parameters of the culture medium are the pH, the osmotic pressure and/or the temperature of the culture medium.

10 8. The process as claimed in Claim 7, characterised in that the parameter of the culture medium is the pH and in that the step b) is taken by reducing the pH by natural acidification.

15 9. The process as claimed in Claim 7, characterised in that the parameter of the culture medium is the temperature, and in that step b) is taken by reducing the temperature.

20 10. The process as claimed in any one of Claims 6 to 9, characterised in that the parameter of the bacteria is the size of the bacteria.

25 11. The process as claimed in Claim 6, characterised in that the distribution of the lengths of each bacterium is predominantly between 0.1 and 10 micrometres, advantageously between 0.5 and 5 micrometres.

30 12. The process as claimed in any one of the preceding claims, characterised in that adaptation step b) is taken by tangential microfiltration.

35 13. The process as claimed in any one of the preceding claims, characterised in that the tangential microfiltration membranes have a porosity between 0.01 and 0.5 μm , advantageously between 0.1 and 0.3 μm .

 14. The process as claimed in any one of the preceding claims, characterised in that in step c) the inlet pressure of

the culture medium in the microfiltration module is between 0 and $3 \cdot 10^5$ Pa.

15. The process as claimed in any one of the preceding
5 claims, characterised in that in steps c) and d) the rate of the permeate is between 0.001 and $0.1 \text{ m}^3/\text{h}/\text{m}^2$ of surface exchange.

16. The process as claimed in any one of the preceding
10 claims, characterised in that in step d) the transmembrane pressure is between $0.1 \cdot 10^5$ and $2 \cdot 10^5$ Pa and advantageously between $0.1 \cdot 10^5$ and $0.5 \cdot 10^5$ Pa.

17. The process as claimed in any one of the preceding
15 claims, characterised in that in step d) the recirculation rate of the washed medium is between 0.5 and $3 \text{ m}^3/\text{h}/\text{m}^2$ of exchange surface and advantageously between 0.8 and $1.2 \text{ m}^3/\text{h}/\text{m}^2$ of exchange surface.

20 18. The process as claimed in any one of the preceding claims, characterised in that it comprises prior to step a) successive steps of revival and preculture of the bacteria.

19. The process as claimed in any one of the preceding
25 claims, characterised in that it comprises an additional step f), following step e), of packaging the liquid concentrate of adapted and viable bacteria in flexible and hermetic bags.

20. The process as claimed in Claim 19, characterised in
30 that it comprises an additional step g), following step f), of keeping the liquid concentrate of adapted and viable bacteria packaged in flexible bags and hermetic at a temperature between -50°C and $+4^\circ\text{C}$.

21. The process as claimed in Claim 20, characterised in
35 that it comprises an additional step h), following step g), of reheating by adapted means of the liquid concentrate of

adapted and viable bacteria packaged in flexible and hermetic bags.

22. A device for executing the process for production of
5 a liquid concentrate of adapted and viable bacteria for use in
foodstuffs as claimed in any one of Claims 1 to 21,
characterised in that it comprises a vat (1) containing a
washing solution, an inlet conduit (2) of said washing
solution in an fermenter (3), said fermenter (3) serving as
10 propagation of the bacteria in a culture medium, an outlet
conduit (4) for conveying the culture medium containing the
bacteria to one or more modules (5) of tangential
microfiltration, said modules (5) allowing separation of said
culture medium into a permeate (6) not containing bacteria and
15 into a concentrate (7) containing the bacteria.

23. The device as claimed in Claim 22, characterised in
that the concentrate (7) is recycled on leaving the filtration
modules (5) by reincorporation into the fermenter (3).

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24. The device as claimed in Claims 22 and 23,
characterised in that the filtration modules (5) comprise from
1 to 10 filtration membranes, each membrane representing from
0.1m² to 150m² of total filtration surface.

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25. A liquid concentrate of adapted and viable bacteria,
characterised in that it is likely to be obtained by the
process as claimed in any one of Claims 1 to 21.

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26. Utilisation of the liquid concentrate of adapted and
viable bacteria as claimed in Claim 25 as a foodstuff
additive.

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27. An additive food product, characterised in that the
foodstuff additive utilise is a liquid concentrate of adapted
and viable bacteria as claimed in Claim 25.

28. The additive food product as claimed in Claim 27, characterised in that it is a milk product and/or a beverage.

5 29. A manufacturing process for an additive food product as claimed in any one of Claims 27 or 28, characterised in that the liquid concentrate of adapted and viable bacteria is added to the food product at the end of the production line and preferably prior to packaging of the food product.